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Marianne Gullberg

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GESTURES AND THE DEVELOPMENT OF SEMANTIC REPRESENTATIONS IN FIRST AND SECOND LANGUAGE ACQUISITION

Marianne GULLBERG

Abstract

This paper argues that speech-associated gestures can usefully inform studies exploring the development of meaning in first and second language acquisition. The example domain is caused motion or placement meaning (*putting a cup on a table)* where acquisition problems have been observed and where adult native gesture use reflects crosslinguistically different placement verb semantics. Against this background, the paper summarises three studies examining the development of semantic representations in Dutch children acquiring Dutch, and adult learners' acquiring Dutch and French placement verbs. Overall, gestures change systematically with semantic development both in children and adults and (1) reveal what semantic elements are included in current semantic representations, whether target-like or not, and (2) highlight developmental shifts in those representations. There is little evidence that gestures chiefly act as a support channel. Instead, the data support the theoretical notion that speech and gesture form an integrated system, opening new possibilities for studying the processes of acquisition.

Keywords: gesture, L1 acquisition, L2 acquisition, semantic development, verb meaning, caused motion.

1. Introduction

Languages vary a great deal in the meanings they express, for instance in how they encode information concerning space and motion (e.g., papers in Aurnague, Hickmann & Vieu 2007; Levinson & Wilkins 2006; Strömqvist & Verhoeven 2004). While a lot of effort has gone into charting the acquisition of form and structure, less is known overall about the acquisition of such language-specific semantic knowledge by child and adult learners alike. Influential approaches in studies of first language (L1) acquisition currently assume that children *construct* meanings on the basis of properties of the input rather than map forms onto innate meaning categories (e.g., Lieven & Tomasello 2008). Such assumptions of emerging meanings are supported by observations that children show early sensitivity to language-specific semantic categorisation for instance in the verb domain (e.g., Brown 1998; Choi & Bowerman 1991). Studies therefore explore the role of input frequency (e.g., Saffran 2003), semantic specificity vs. generality (e.g., Theakston, Lieven, Pine & Rowland 2004), and differences between the acquisition of object vs. relational meaning (e.g., Gentner 2006; Gopnik & Choi 1995). In adult second language (L2) acquisition, the questions are somewhat different. A frequent assumption is that adult L2 learners initially acquire words by mapping an L2 form onto an existing L1 meaning through translation, associative learning, or 'lemma mediation' (e.g. Jiang 2000; Kroll & Sunderman 2003). The key issue in L2 studies is therefore to what extent adult learners overcome transfer of semantic-conceptual representations from the L1 and to what extent they *re-construct* meaning to approximate the L2 target.

Both L1 and L2 comprehension studies provide evidence that adult- or targetlike forms do not necessarily have adult- or targetlike meaning (e.g., Coppieters 1987; Goldfield 2000). An important challenge for acquisition studies is to go beyond simply stating *that* learners' meanings differ from those of adult or native speakers, and to explore *how* they differ, and to probe the details of learners' meaning representations at a given point in time during development. This can obviously be done in several ways. This paper will argue that one possibility for production studies is to consider all vehicles of meaning and to examine learners' speech and gestures in conjunction. Speech-associated gestures and language are increasingly seen as a closely-knit system in which both modalities reflect important aspects of meanings selected for expression (Kendon 2004; McNeill 1992, 2005). This integration means that gestures can shed more light on what types of spatial information learners consider for expression than speech alone. A joint analysis of speech and gestures opens new

possibilities for examining how language-specific representations develop in both child and adult learners.

This paper presents an overview of three studies examining the acquisition of verb meaning in the domain of placement (e.g., *put a bowl on the table*) using speech-associated gestures as a tool to explore what language learners mean. After an introduction to gestures and placement, the paper outlines the methodology used, then summarises a study on L1 acquisition of placement verbs, followed by two studies of adult L2 acquisition. The paper closes with a discussion of what gestures reveal about the construction and re-construction of semantic representations, and the notion of gestures as a 'compensatory mode of expression'.

2. Why gestures?

There is considerable observational, experimental behavioural and neurocognitive evidence indicating that language and gestures are tightly linked in production and comprehension (Kendon 2004; Kita 2009; McNeill 2005; Willems & Hagoort 2007 for overviews). The modalities are temporally and semantically coordinated such that gestures and speech express similar meaning at the same time in production. Because gestures convey meaning in a different format from linear speech, through iconicity and spatial proximity, the overlap in meaning across modalities is global rather than exact, and gestures can provide information about meaning not easily expressed in speech (e.g., size and shape). Gestures also reflect information structure in that they typically align with newsworthy or focused elements in an utterance (Levy & McNeill 1992). Depending on how information is syntactically organised, they also reflect syntactic organisation of semantic elements, also known as 'lexicalisation patterns' (e.g., Kita *et al*. 2007). The crossmodal coordination means that gestures reflect language-specific linguistic organisation and meaning seen in different gestural forms and gestural timing relative to speech (e.g., Kita 2009; McNeill 2005). Put differently, gestures are not only vehicles of linguistic meaning in general, but of language-specific meaning. Following McNeill (1992; 2005), many scholars now argue that the observed cross-modal coordination is indicative of shared conceptual representations between the modalities (e.g., De Ruiter 2000; Kita & Özyürek 2003; Krauss, Chen & Gottesman 2000) although the theoretical positions differ in their detailed views of the relationship.

The connection between language and gesture for the expression of meaning has already informed language acquisition studies. In L1 acquisition gestures

have been taken as evidence of communicative intentions in prelinguistic infants from 9 months onwards (Bates *et al.* 1979), with communicative pointing and representational gestures appearing at 12 months (e.g., Butterworth 2003; Capirci *et al.* 2005; Caselli & Volterra 1990; Liszkowski, Carpenter & Tomasello 2007). At the one-word stage, utterances are often cross-modal (one gesture, one word). Speech-gesture combinations with complementary meanings (e.g., point to drawer and say 'ball') reliably predict the onset of two-word combinations (e.g., Capirci *et al.* 1996; Iverson & Goldin-Meadow 2005). Crossmodal combinations are also seen in pragmatic development where younger children express agreement and refusal in gesture alone before using both modalities in parallel from age 2;0 onwards (e.g., Guidetti 2005). The combined use of speech and gesture also develops, for example in the increase of rhythmic beat gestures with increasing narrative sophistication (e.g., Colletta 2004; Jancovic, Devoe & Wiener 1975). A number of studies also indicate that children's gestures reflect language-specific semantic and syntactic preferences as early as age 4-5, for example targeting path elements in both modalities when talking about motion (e.g., Furman, Özyürek & Allen 2006; Gullberg, Hendriks & Hickmann 2008; see Özyürek *et al*. 2008 for a different pattern).

Gesture production in adult L2 acquisition has been much less studied (Gullberg 2006b, 2008, 2009 for overviews). However, gestures have been examined as part of L2 learners' compensatory communication strategies to bridge the gap between communicative intentions and available linguistic means (e.g., Poulisse 1994). L2 learners use gestures to overcome lexical difficulties by eliciting assistance from interlocutors (Gullberg 1998, to appear-b; McCafferty 2004), to resolve grammar- and discourse-related problems (Gullberg 2003, 2006a), and to manage problematic interaction resulting from non-fluent production (Gullberg 1998, to appear-b). L2 learners' gestures have also been examined to gauge the degree of crosslinguistic influence or transfer of semantic elements. These studies show evidence of crosslinguistic influence both from the L1 on the L2 (e.g., Choi & Lantolf 2008; Kellerman & Van Hoof 2003; Stam 2006) and from the L2 on the L1 (e.g., Brown & Gullberg 2008), suggesting that meaning representations interact in L2 learners.

To summarise, speech and gesture form a closely-knit system for conveying meaning, and language learners express meaning in gestures as well as in speech. Acquisition studies have drawn on gestures to gain information about language learners' expressive intentions and their current knowledge states more generally. But gestures are equally well suited to probe semantic development in more detail.

3. The meanings and acquisition of placement verbs

Placement is a sub-domain of caused motion where an agent causes an object to move to an end location while maintaining (manual) control over it until it reaches its final destination (e.g., *Anne put the bowl on the table*, *cf.* Slobin *et al.*, to appear). The domain displays considerable crosslinguistic diversity and semantic complexity (e.g., Kopecka & Narasimhan, to appear). Crosslinguistically, verb inventories range from systems with a single general placement verb (e.g., Mandarin Chinese *fang* 'put') , via small sets of obligatory verbs whose semantics are often based on posture (e.g., the Swedish caused posture verbs *sätta/ställa/lägga* 'set/stand/lay'), to large sets of classificatory verbs (e.g., Tzeltal verb roots such as *xij-* 'place sticklike things regardless of orientation'; Brown 2006).

French is a language of the first type with a general verb *mettre* 'put' (e.g., Hickmann 2007). Dutch is a language of the second type where speakers must choose between one of two caused posture verbs *zetten* 'set' and *leggen* 'lay' to label any given placement event. No general superordinate term exists. The verb choice for any given placement event is based on a combination of factors including the orientation, the shape and disposition of the object to the ground (Lemmens 2006; Van Oosten 1986). For instance, a bottle vertically placed on its base must be described with *zetten* 'set'. It would be ungrammatical (or non-veridical) to describe it with *leggen* 'lay'. Conversely, a bottle placed on its side or an object lacking a base such as a ball must be described with *leggen* 'lay'. German also has caused posture verbs, *stellen* 'stand' and *legen* 'lay', but the German system is more diversified than the Dutch. Posture verbs are only used if the actual position of an object is known, and otherwise more general verbs are used (Kutscher & Schultze-Berndt 2007). English, finally, is a mixed system with both a frequent general placement verb, *put*, and a set of infrequent caused posture verbs, *set* and *lay* (David 2003; Pauwels 2000).

The crosslinguistic differences in verb semantics are further reflected in systematically different gesture patterns (Gullberg, to appear-a; submitted-a; submitted-b; Hoetjes 2008; Lehmann 2007). Studies using techniques described in more detail in section 4 have shown that French speakers' gestures predominantly express the path element of the movement and chiefly align temporally with the verb (e.g., *met* 'puts'), thus reflecting the semantic focus on the action of the caused movement. Dutch speakers' gestures, in contrast, mainly incorporate the displaced object in handshapes superimposed on the path of the movement and they align with the verb (e.g., *zet* 'sets'). Dutch speakers thus target the action of causing a specific object to move. German speakers' gestures

express only the path of the movement like the French, but predominantly align with locative ground expressions (e.g., *in die Ecke* 'in the corner'), suggesting a semantic focus on the caused motion towards a goal ground (*cf.* Carroll & von Stutterheim 2003). Interestingly, English speakers' gestures look very similar in form and timing, expressing mainly path in form and aligning with locative expressions. These differences in speech-gesture patterns highlight the crosslinguistic differences in the spatial information targeted in the verbal meaning representations.

Despite the variation in size and semantic specificity of placement verb inventories the L1 and L2 acquisition of placement verbs has hitherto received surprisingly little attention. This is partly because the (English) verbs have been seen as cognitively basic and simple (Pinker 1989: 254), and also because target-like forms often appear very early in L1 development (e.g., Goldberg, Casenhiser & Sethuraman 2004), even in languages with multiple verbs. However, although the verb forms may be acquired early, their meanings may not be. Even the general English verb *put* causes difficulties as late as age 4 (Bowerman 1978). A number of studies indicate that crosslinguistic differences in semantics and argument structures lead to different developmental trajectories (e.g., Brown 2008; Hickmann & Hendriks 2006; Narasimhan & Gullberg 2006). For instance, Slobin *et al.* examined the L1 acquisition of placement verbs in four satellite-framed (English, German, Russian, Finnish) and four verb-framed languages (Spanish, Hindi, Turkish, Tzeltal) (Slobin *et al*., to appear). They showed that the acquisition patterns differ typologically such that children learning satellite-framed languages emphasised goals (e.g., 'box' in *put the pencil in the box*) and vectors/relations (e.g., motion towards and 'in') early, whereas children learning verb-framed languages emphasised actions (e.g., 'put'). In addition, the size of language-specific verb inventories led to even more fine-grained differences.

Narasimhan & Gullberg (2006; to appear) explored the L1 acquisition of placement verbs in Tamil and Dutch, respectively, in children aged 3-6. Tamil, like English, has a frequent general verb *veyyii* 'put' and two infrequent specific posture verbs, *nikka veyyii* 'make-stand' and *paDka veyyii* 'make-lie'. Dutch, as seen above, has two frequent and obligatory posture verbs, *zetten* 'set' and *leggen* 'lay'. Frequency accounts of acquisition would predict that Tamil children acquire the frequent general verb early but not the specific and infrequent caused posture verbs, whereas Dutch children should acquire the frequent and obligatory caused posture verbs early. However, the results showed that Tamil children used both types of verbs in adult-like fashion already at age 3, whereas Dutch children did not even at age 5. More specifically, Dutch children tended

to pick one verb, *leggen*, and use it across the board as a default placement verb. The meanings of the Dutch posture verbs thus cause difficulties although they are obligatory and frequent in the input to children. A possible explanation is the semantic opacity of the Dutch verbs. The Tamil posture verbs are compounds where the caused motion and the end-state of the object are encoded in separate morphemes, thus keeping the semantic elements distinct. In contrast, the Dutch verbs conflate these components into a monomorphemic *portemanteau* form, obscuring the complex semantics. Furthermore, the Dutch posture verbs are extended to contexts beyond concrete placement, possibly further masking the verb meanings.

Placement verb semantics also cause difficulties for L2 learners, in particular for L2 learners moving from general one-term placement verb systems to semantically specific, multi-term systems. For instance, Spanish, Polish and Finnish learners of L2 Swedish all have difficulties acquiring the specific Swedish caused posture verbs *sätta/ställa/lägga* 'set/stand/lay' (Viberg 1998). All learner groups over-generalised one placement verb to all types of placement, although this tendency was modulated by influences from the L1s. Spanish and Finnish learners, whose L1s make no orientation distinctions, overextended one of the three Swedish verbs to all scenes. In contrast, Polish learners, whose L1 has a different posture verb system, differentiated the Swedish verbs more even if they were not necessarily target-like. In contrast, transitions from specific multi-term systems to general single-term systems are not assumed to cause much difficulty, since learners typically do not display any form errors. Note, however, that in the transition from specific to general terms, the target form is under-specified and could obscure non-targetlike meaning. In fact, L2 comprehension studies often indicate that L2 comprehension differs from native comprehension even at advanced stages (e.g., Coppieters 1987). There is thus reason to suspect that targetlike forms in use do not necessarily have target-like meaning.

Although the evidence overall suggests that the acquisition of placement verbs is not straightforward, we still know surprisingly little about what meanings learners ascribe to specific forms that are in use. One way to probe the nature of learners' developing semantic representations is to consider additional vehicles of meaning and to study speech and gestures in conjunction, drawing on the documented crosslinguistic differences in adult native speech and gestures. In the following, three studies are summarised that use gesture analysis to explore the details of learners' semantic representations of placement.

4. Data and methods in the studies reviewed

The data reviewed here come from (a) adult native speakers of Dutch (*N*=22), French (*N*=12), German (*N*=12) and English (*N*=14); (b) Dutch children acquiring Dutch (*N*=12, aged 3;1 to 6;0); and (c) adult English learners of L2 Dutch (*N*=10), and Dutch (*N*=12) and German (*N*=10) learners of L2 French.

In all studies, data were collected through a video-based event description task. The task requires a speaker (the Director) to watch brief video clips of an actor putting objects on various grounds and then to describe from memory to an interlocutor (the Matcher), who has not seen them, what happened. The Matcher must then either draw the objects on a picture of the empty room (adult task, Gullberg, to appear-a; submitted-a; submitted-b) or select a matching still picture from a set (child task, Gullberg & Narasimhan, to appear; Narasimhan & Gullberg 2006). The stimuli contain simple target scenes of horizontal (e.g., bottle on its side) and vertical placement (e.g., books on shelf), typically labelled with *leggen* 'lay' (1) and *zetten* 'set' (2) respectively in Dutch.

(1) *en de fles legt zie links* (10D1)
'and the bottle she lies to the left'

(2) *vier boeken en die zet ze in de kast* (20D1)
'four books and she sets them on the shelf'

These target scenes are intermingled with filler scenes representing other relationships between figures and grounds (e.g., shirt on hanger, chewing gum under table, hat on head). During the task, no mention is made of gesture. All sessions are audio- and videotaped.

The speech analyses draw on the first spontaneous description of each placement event, excluding elaborations following questions. Examples are given in (3) (native English) and (4) (L2 Dutch), with the first description underlined.

(3) *she picks out a number of books […] and <u>she puts them on the uhm shelf</u>* (7E1)

(4) eerst raapt ze vier studieboeken op en <u>die gaan op die hoge kast</u>
'first she picks up four textbooks and <u>they go on the high shelf</u> (12E1D2)

The analyses focus on the verbs used to describe the placement event, and on constituent order (e.g., Agent-Verb-Object-Locative).

The gesture analyses target gesture strokes (the expressive part of the gestural movement) and post-stroke holds (where hands are temporarily held

immobile in space) co-occurring with the first placement descriptions (Kendon 1972, 2004; Kita, Van Gijn & Van der Hulst 1998; Seyfeddinipur 2006), excluding gestures occurring with disfluencies or multiple hesitations (*cf.*, Gullberg 1998). Identified gestures are coded for (1) form, (2) timing relative to speech; and (3) co-expressivity with speech. The form scheme codes for whether gestures express (a) object information in handshapes reflecting the object superimposed on path; or (b) only path of movement in lax hands performing a 'spatial excursion' away from the speaker's body (*cf.*, Kendon 2004). The timing coding categorises the speech that co-occurs exactly with the gesture into Verb (e.g., *zet* 'set'), Figure Object (*de fles* 'the bottle'), Locative phrase (*op de tafel* 'on the table'), and Other (*diagonaal met de punt naar beneden* 'diagonally with the corner downwards'). Finally, the co-expressivity coding examines whether the semantic elements in gesture show (a) 'total overlap' with speech; (b) whether gestures add information; or (c) whether speech adds information. All coding is subject to interrater reliability measures. Analyses draw on mean proportions of gestures displaying a particular property.

5. Gestures and L1 acquisition of Dutch placement verbs

The first study targeted Dutch children acquiring the Dutch placement verbs *zetten* 'set' and *leggen* 'lay' (Gullberg & Narasimhan, to appear). Specifically, it explored what Dutch children who use only one of the two Dutch placement verbs, *leggen* 'lay', as a default for all placement scenes take this verb to mean. A key question was whether children *construct* the meaning of placement verbs gradually, or whether they have a complete meaning representation at the outset but simply experience difficulties mapping the right label onto it. Gesture data can elucidate this issue. Children using only one verb may produce gestures that resemble the adult Dutch pattern, incorporating the displaced object. This would indicate that they are aware of the relevance of the object although they are unable to express the object information and its end state in speech, or that they are imitating adults' gestures or the action seen on the video. Alternatively, children may produce gestures that reflect their current semantic representation, that is, a representation without the object which targets only the movement component of the caused motion, as reflected in gestures expressing only path.

The results supported the second option. Overall, the children predominantly produced path-only gestures and very few gestures incorporating objects in handshapes in striking contrast to Dutch adult preferences. More importantly,

those children who used only one verb, *leggen* 'lay' produced significantly fewer object-incorporating gestures than those children who had started to use both placement verbs, *zetten* 'set' and *leggen* 'lay'. The appropriate use of the two verbs was also positively correlated with increased production of object-incorporating gestures. That is, when children used only one verb they gestured only about path, suggesting that the meaning of this default verb was something akin to 'cause to move' or 'put' without any attention to the object. Conversely, when children used both verbs, they seemed to have incorporated the object in its end state into the semantic representation, meaning roughly 'cause a specific object to move to an end state', as reflected in their distinctions between placement of objects of different kinds and orientations. The attention to the object was reflected in gestures incorporating object information in handshapes.

Overall, speech and gesture were co-expressive in these child learners. The parallelism in speech and gesture suggests that gestures were not used to compensate for meaning not yet available to speech. Further, children's gestures were neither imitations of adult gestures nor of perceived actions. Rather, gestures reflected the details of children's current semantic representations. Importantly, this suggests that children do not start with an adult-like placement verb meaning but rather construct it, gradually adding semantic elements, specifically object information, to the representations.

6. Gestures and L2 acquisition of Dutch and French placement verbs

The issue at stake in L2 studies of the acquisition of placement verb meaning is whether adult learners *re-construct* meaning in a second language, that is, whether they adjust L1 meaning representations to resemble the representations of the target language. Recall that, moving from English (with its general verb meaning 'cause to move') into Dutch (with its two obligatory placement verbs) will lead to errors if no adjustment is made to the L1 meanings. To acquire language-specific meanings a learner must detect the L1-L2 differences and adjust the L2 accordingly. The re-construction of meaning may involve shifting semantic boundaries of existing L1 categories, adding or abandoning semantic elements relevant in the L1, processes hypothesised to cause difficulties (e.g., Ijaz 1986; Kellerman 1995).

Adult learners of L2 Dutch whose L1 only has a general placement verb should have similar difficulties as Dutch children adding the object information to their representations. A study of adult English learners of L2 Dutch examined

whether the presence of low-frequent cognates in the L1, 'set' and 'lay', might alleviate the difficulties of acquiring the Dutch verbs and help target the object information (Gullberg, to appear-c). Although the participants were resident in the Netherlands (length of residence ranged from 4 months to 19 years) and scored above 65% on a standardised Dutch proficiency test, they all had serious difficulties with the Dutch placement verbs in speech. The L1 cognates seemed to be of no help. Learners over-used one of the Dutch verbs, *zetten* 'set', but also used dummy verbs like *gaan* 'go' and *doen* 'do'. Moreover, despite over-generalising *zetten* 'set' to all scenes, they preferentially used it for vertical placement scenes, and mainly used dummy verbs and intransitive constructions for horizontal scenes. Overall, the speech data suggest that the English learners attempted to express the Ll–based general meaning 'cause to move' by over-generalising one of the placement verbs or using dummy verbs. However, their differentiated use depending on object orientation suggests some sensitivity to the need to distinguish events based on attention to the object. Again, gesture data can elucidate whether English learners attended to the object information although it was not expressed in speech.

Overall, the English learners predominantly produced simple path gestures and much fewer gestures incorporating the objects, a pattern similar to their L1 preferences but different from those of native Dutch speakers. The majority of the gestures were co-expressive with speech, that is, the learners chiefly used a non-posture verb while gesturing about path. Further, in cases of discrepancy, speech was likely to be more specific than gesture: caused posture verbs were often accompanied by gestures expressing only path. Overall, adult English learners of Dutch did not use gesture to express meaning not yet available to speech. Instead, gestures reflected the learners' current semantic representations: a general, L1-based 'cause to move' meaning. However, the data also suggested a gradual re-construction of meaning and addition of object information.

A transition from a verb system with fine-grained semantic distinctions to a more general verb system is assumed to cause few difficulties. However, under the assumption that verb meanings are not identical crosslinguistically, all transitions should require semantic adjustment, even if the target language forms obscure more fine-grained meaning. A third study explored this issue by examining the acquisition of the general placement verb *mettre* 'put' in L2 French by adult Dutch and German learners, both of whom have caused posture verb systems in the L1s (Gullberg, submitted-b). The participants were students in their 9-11th year of study of French as a foreign language in a classroom setting in their home countries. Nobody had spent more than three consecutive

weeks in a French-speaking country, or had any sustained contact with native French speakers.

As expected, the participants had few difficulties with the French placement verbs. Both the Dutch and the German learners used the same range of verbs (e.g., *mettre* 'put', *placer* 'place', *coller* 'stick', *suspendre* 'hang'), and to the same extent as native speakers of French. Moreover, the placement descriptions were also syntactically organised in the same way as those of native speakers. There was no evidence that the learners attempted to introduce object-related information in adverbial expressions like *debout* 'standing'. Overall, speech looked targetlike.

The gesture analysis revealed a more complex picture, however. The Dutch learners fell into three groups displaying different preferential patterns in gesture. One group of learners predominantly gestured about objects, much like native speakers of Dutch. Another group gestured predominantly about simple path, displaying a French-like preference. A third group showed no preference at all, but gestured equally about objects and simple path. The German learners of French continued to align path gestures with locative expressions in German style, but were nevertheless significantly more likely to align path gestures with verbs than were native speakers of German, suggesting a beginning shift towards a French focus on verbs and actions, although they did not reach French-like levels. Overall, the gesture data indicated both transfer of L1 semantic representations into the L2 and beginning shifts towards target representations. Transfer was seen in the Dutch learners' object-gestures indicating a persistent attention to objects reflecting underlying Dutch placement verb semantics although the gestures accompanied French verbs. Transfer was also seen in the German learners' continued alignment of path gestures with locative expressions indicating a continued attention to goals consistent with the German placement verb semantics. Note that the transfer interpretation is supported by the different pattern across the groups; there was no indication of a general learner tendency to gesture about objects. Shifts towards the target language semantics could also be seen in Dutch learners' path-only gestures, suggesting a shift of attention away from objects and towards only the path of the movement, approaching the target semantics of the French placement verb *mettre* 'put'. Similarly, the increase in German learners' gesture alignment with verbs suggests a shift of attention away from goals and towards actions, again approaching the target semantics of French. As the previous studies, this study indicated that gestures reflect the details of learners' current semantic representations. However, because speech in this case was partly under-specified, the process of transfer led

to cases where speech and gestures were not entirely co-expressive, but where gestures provided more detail than speech, as in the Dutch learners gesturing about objects while using the general verb *mettre* 'put'.

7. Discussion and conclusions

The findings from the studies summarised shed new light on the acquisition of placement verb meanings. Specifically, the gesture data go beyond information in speech and provide (1) details about learners' semantic knowledge and the elements they consider as relevant for expression at a given moment in time; and (2) information about the developmental shifts of semantic representations.

Looking first at meanings considered, in children and adult English learners of Dutch, non-target-like verb use is reflected in non-target-like gesture production. Importantly, non-targetlike gestures reveal what the non-targetlike default verbs 'mean'. That is to say, the absence of object information in these gestures strongly suggests that Dutch children and English adults do not consider objects as semantically relevant at these stages. In the case of adult Dutch and German learners of French, targetlike speech is sometimes accompanied by target-like gestures, sometimes by non-targetlike gestures. In both cases, gestures can reveal what meaning elements learners consider as relevant. Some learners show evidence of transfer of L1 object-related representations, but others show evidence of having re-constructed meaning in the direction of the more general target, shifting attention away from objects.

In Dutch children the gesture data thus indicate a transition from representations where only caused movement plays a role (path-only gestures) to representations where the located object in its end state has become an obligatory element of the verb semantics (gestures incorporating the object with the path). Adult English learners of Dutch show a similar trend with some learners operating with a seemingly L1-based representation of caused movement only (path-only gestures). Strikingly, however, a re-construction of meaning does not seem to be out of reach because learners who use targetlike forms also produce gestures incorporating objects, having added the object to their representations. Crucially, though, they do not gesture about objects unless they also talk about them. In the case of adult Dutch and German learners of French, the acquisition problem is different. Dutch learners must abandon a semantic element (objects) and German learners must shift attention from goals to the movement of caused motion. Again, the gesture evidence suggests that, although there are learners

who continue to speak and gesture according to L1 semantics, re-construction is possible, with some learners showing shifts of attention to different spatial information in gesture. In sum, the gesture data provide evidence of gradual shifts in semantic representations in both children and adults: a gradual addition of object information in Dutch children and English learners of L2 Dutch; and a gradual abandonment of object and goal information in Dutch and German learners of L2 French, respectively.

It is noteworthy that the modalities are overall co-expressive. First, there is no evidence that gestures imitate practical placement actions or the actions seen on the videos. This would have yielded similar behaviour in all language and age groups. Second, there is little evidence that learners use gestures mainly as a support system to communicate (object-related) information not expressible in speech. Instead, gestures seem to reflect a change in focus only once a semantic element has been integrated into the verb's meaning representation. Put differently, learners only gesture about objects (in Dutch) once the object has been incorporated into the semantic representation of the placement verbs.

The overall absence of gestural compensation is perhaps surprising. Gestures clearly provide rich affordances for speakers to convey (spatial) meaning and they have long been regarded as a useful compensatory device to express content not easily encoded in speech in studies of aphasia (Lott 1999; Rose 2006), specific language impairment (e.g., Blake *et al.* 2008; Fex & Månsson 1998), and other atypical language development such as Down's syndrome (Stefanini, Recchia & Caselli 2008). Studies of gestures as precursors to speech in L1 acquisition (e.g., Capirci *et al*. 1996; Iverson & Goldin-Meadow 2005) and as communication strategies in L2 (e.g., Gullberg 1998; McCafferty 2004) are inscribed in the same general framework of assumptions.

However, there are several reasons why the view of gesture as mainly a compensatory device should be treated with caution. The notion of compensation remains ill- or under-defined (*cf.* Gullberg, de Bot & Volterra 2008). The traditional view of gesture compensation assumes that speakers *deliberately* recruit gestures to compensate for expressive gaps and that gestures therefore *replace words*. An alternative view assumes that gestures reflect current semantic-conceptual representations and give information on expressive intentions *regardless* of speakers' deliberate intentions to recruit gestures. This latter view finds support in current speech-gesture theories many of which (tacitly) incorporate compensatory assumptions (Gullberg, de Bot & Volterra 2008; Nicoladis 2007 for discussions). For instance, one line of research assumes that gestures facilitate 'thinking' or help translate thought into language by facilitating the

organisation and packaging of conceptual information for expression (Alibali, Kita & Young 2000; Kita 2000; Goldin-Meadow 2003). Another line of work argues that gestures facilitate lexical retrieval through cross-modal priming (Frick-Horbury & Guttentag 1998; Krauss *et al.* 2000) or maintenance of mental imagery (Wesp *et al.* 2001). Finally, it has been suggested that gesture may help overcome 'lexical gaps' crosslinguistically. For instance, if a language does not have readily available means to encode manner of motion (e.g., *twirl*, *swing*), speakers of that language may express manner of motion in gesture rather than in speech (the 'Manner fog hypothesis', McNeill 2000). Although these theories are not explicit about their claims regarding compensation, they open for very different forms of 'compensation' and complementary distribution of information across modalities. It remains an open question whether compensation works in the same way for all the phenomena and the language levels they implicate. More importantly, it is far from clear that they will affect all types of learners in the same way. It seems likely that there are considerable differences in how gestures may serve as a compensatory mode. This is an empirical issue in need of study in its own right.

Second, it is not clear whether all forms of non-target-like behaviour are to be seen as compensatory. Clearly, not all learner production is best characterised as strategic problem solving. Over-generalisation is not a matter of strategic compensation, but a reflection of the developmental process. Both L1 and L2 production can be fluent even if not targetlike. Fluent but non-targetlike production is unlikely to be subject to strategic behaviour. Conversely, not all difficulties will become overt, especially in L2 production. For L1 acquisition, it is doubtful whether one can talk about strategic compensation at all since that presupposes that the learner 'knows' that there is something to compensate for. While the difficulties of identifying and defining compensatory behaviour have often been discussed in studies of L2 acquisition, the problems outlined here have received very little direct theoretical attention in L1 studies and even less so in studies considering gestures as compensation. Overall, then, the observed co-expressivity in speech and gesture in language development is perhaps not so surprising given the difficulties in defining gesture as compensatory.

In fact, the results are consistent with other findings of cross-modal parallelism. A recent study of American 14-to-34-month-old children showed that gestures typically foreshadow speech when linguistic constructions are first established (Özçalışkan & Goldin-Meadow 2009). However, once a construction is in place, gestures no longer express additional information to speech. Instead, the modalities are co-expressive. In the Dutch child data, the placement

constructions were clearly well established and 'only' the semantics was still under construction. Children may not rely on gestures as support for such 'fleshing out' of the representations. Instead, their gestures reflect their current meanings (e.g., Furman *et al*. 2006; Gullberg, Hendriks & Hickmann 2008). For adults, in cases where their L1 representations are more general than the target, there is little evidence that they use gesture as support for additional information. That is, as for L1 acquisition, the gestures closely reflect the current state of the semantic representation. However, in cases where the L1 representations are more specific, gestures may express supplementary information reflecting transfer of the more specific underlying semantics. That said, there is little evidence that such gestures are instantiations of deliberate compensation. Rather, they again seem to be reflections of development. Learner data therefore provide support for the notion that speech and gestures form an integrated system. It is worth noting, though, that L2 data in particular show that speakers can and do express different elements in speech and gestures, especially in cases of lexical gaps in the L2. The potential decoupling of co-expressivity in L2 data therefore puts pressure on speech-gesture theories to specify how great the overlap between the modalities must be to count as an 'integrated' system.

To conclude, language acquisition studies can gain important insights into the development of semantic representations by considering language learners' gestures as well as their speech. Gestures are not only informative about language development as precursors to speech, but they open a window onto current linguistic knowledge, shedding light on the type of semantic information learners take into account as relevant for expression at a given stage in development. As a result, they also provide a more gradient view of the process of acquisition and the developmental trajectories of meaning. In the domain of placement verbs, they show that children construct meaning gradually, and that adult L2 learners transfer L1 meanings, but that they are also able to re-construct meanings gradually.

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Résumé

Cet article propose que les gestes co-verbaux des apprenants fournissent des informations importantes sur le développement sémantique dans l'acquisition L1 et L2. Le domaine étudié est le déplacement provoqué (*mettre une tasse sur la table*) où des difficultés d'acquisition ont été observées ainsi que des différences systématiques interlinguistiques dans les gestes des locuteurs natifs adultes. Avec ce point de départ, cet article survole une série d'études qui examinent le développement sémantique chez les enfants apprenant le néerlandais L1 et chez les adultes apprenant le néerlandais et le français L2. Les caractéristiques des gestes changent avec le développement sémantique : (1) ils reflètent ainsi les éléments sémantiques inclus dans les représentations sémantiques courantes, qu'elles soient 'correctes' ou non ; et (2) mettent en évidence les modifications des représentations. Le parallélisme trans-modal suggère que les gestes ne sont pas essentiellement une modalité de support mais qu'ils constituent un système intégré avec la parole ouvrant des voies nouvelles pour étudier l'acquisition des langues.